their simple structure. As compared to other spectrometry devices, micromachining is especially easy as the electrode structure of the ion mobility storage traps does not need to be extremely precise. Chemical etching, plasma etching, laser etching and LIGA several examples of micromachining techniques that may be used to properly shape electrodes of the ion mobility storage traps.

In order to compensate for the lower amount of ions generated by a microfabricated storage trap (due to its size, e.g.), several microfabricated storage traps may be used in combination as an array. For example, the device illustrated in FIG. **37** may include a plurality of storage traps manufactured on a silicon wafer.

The above description of the examples of the invention describe :specific storage trap examples in combination with specific ion mobility storage trap systems (such as those illustrated in FIGS. **10**A and **10**B), in combination with specific ionization sources, and in combination with other spectrometry devices. Additional embodiments of the invention include the replacement of the described examples of the storage traps, the trap systems, the ionization sources and other spectrometry devices with any of the corresponding elements described elsewhere in the specification.

Also, the above description is intended only to exemplify the invention. Modifications and variations of these examples will be obvious to those skilled in the art which still achieve the spirit of this invention. For example, the above description describes two specific examples of systems which can be used to provide the appropriate voltages to traps. However, these examples may be replaced by any voltage source which achieves the appropriate electric field within a trap volume. In addition, the description of the trap structures are only several detailed examples; many different trap structures will be apparent to those skilled in the art which fall within the scope of this invention.

Also, the above description details the positioning or localizing of the ions along an axis (or along a line or curve), the separation of the ions and the storage of the ions with respect to several different examples. It is intended that any of the disclosed examples may be utilized to perform only one of these functions or any combination thereof. Similarly, it is intended that one or more of these functions may be encompassed by other devices which fall within the scope of this invention.

It is intended that any of the disclosed storage trap examples may be used with any voltage generation source, and/or any ion mobility storage trap system, and/or in combination with any of the disclosed spectrometry devices (such as the gas chromatographic column, the drift tube or mass spectrometer) and/or other spectrometry devices, and/or with any type of ionization source. Many other modifications other than those specifically mentioned here will be obvious to those skilled in the art.

The above detailed descriptions of the examples of the invention are for illustrative purposes. Modifications and variations of these examples will be obvious to those skilled in the art which still achieve the spirit and scope of the present invention.

I claim:

1. A method of separating and storing ions, comprising:

(a) applying an electric field to a volume containing a neutrally charged carrier gas and ions; and
separating the ions in the volume containing the neutrally charged carrier gas according to type to temporarily fixed positions within the volume as a function of the electric field applied to the volume and mobility characteristics of the ions, the mobility characteristics of the ions resulting from multiple collisions of the ions with molecules of the neutrally charged carrier gas.

2. The method of claim **1**, further comprising:

(b) removing the separated ions from the volume by changing the electric field applied to the volume to move the temporarily fixed positions.

3. The method of claim **1**, wherein step (a) includes

applying the electric field to the volume with a voltage, the voltage varying with respect to time in a periodic manner, the integral of the voltage over a period being equal to first value, and the shape of the waveform of the voltage being asymmetric about the first value.

4. The method of claim **1**, wherein step (a) includes

applying the electric field to the volume, the electric field varying with respect to time to change the mobility coefficient value of the ions at a first portion of the volume.

5. The method of claim **4**, wherein step (a) includes

applying the electric field to the volume, the electric field at a second portion of the volume maintaining a substantially constant mobility coefficient value of the ions.

6. The method of claim **4**, wherein step (a) includes

applying the electric field to the volume, the integral of the electric field with respect to time at a position within the volume equal to a first value, and the shape of a waveform of the electric field with respect to time being asymmetric about the first value.

7. The method of claim **6**, wherein step (a) includes

applying the electric field to the volume, a strength of the electric field changing as a function of position within the volume.

8. The method of claim **1**, wherein the carrier gas is maintained at a pressure greater than or equal to 10^{-3} mm Hg.

9. The method of claim **1**, wherein the carrier gas is maintained at a pressure greater than or equal 10^{-2} mm Hg.

10. The method of claim **1**, wherein the carrier gas is maintained at atmospheric pressure.

11. The method of claim **1**, wherein the carrier gas is maintained at greater than atmospheric pressure.

12. The method of claim **1**, further comprising

(b) injecting a sample into the volume containing the carrier gas; and

(c) ionizing the sample to create the ions.

13. A method of separating and storing ions within a trap, the trap including at least two electrodes positioned about a trap volume containing a carrier gas, comprising:

(a) applying a voltage across the at least two electrodes creating an electric field within the trap volume, and separating and storing the ions according to a difference in mobility experienced by each ion as a function of a change in the electric field, the mobility of the ions resulting from multiple collisions of the ions with molecules of the carrier gas.

14. The method of claim **13**, wherein step (a) includes

applying a voltage periodically varying, the voltage having a DC component and an AC component, the AC component being asymmetrical.

15. The method of claim **14**, further comprising:

(b) changing the DC component of the voltage to remove the ions from the trap volume.